WATER QUALITY TERMS

pH (HYDROGEN ION CONCENTRATION)
(1) A convenient method of expressing the acidity or basicity of a solution in terms of the logarithm of the reciprocal (or negative logarithm) of the hydrogen ion concentration. The pH scale runs from 0 to 14; a pH value of 7.0 indicates a neutral solution. Values above 7.0 pH indicate basicity (basic solutions); those below 7.0 pH indicate acidity (acidic solutions). Natural waters usually have a pH between 6.5 and 8.5. Because the units are derived from common logarithms, a difference of one pH unit indicates a tenfold (10^1) difference in acidity; similarly, a difference of two units indicates a hundredfold (10^2) difference in acidity. The term originally derived from "potential of hydrogen," or hydrogen power. (2) A term indicating the hydrogen ion concentration of a solution, i.e., a measure of the solution's acidity. The term (from French, pouvoir hydrogène, or literally, "hydrogen power") is defined as the negative logarithm of the concentration of H+ ions (protons): pH = -log10 [H^+], where [H^+] is the concentration of H^+ ions in moles per liter (see Mole). Because H^+ ions associate with water molecules to form hydronium (H_3O^+) ions (see *Acid* and *Base*), pH also is often expressed in terms of the concentration of hydronium ions. In pure water at 22 C (72 F),H_3O^+ and hydroxyl (OH^-) ions exist in equal quantities; the concentration of each is 0.107 moles/liter. Consequently, the pH of pure water is -log (0.107), which equals log 107, or 7. If an acid is added to water, however, an excess of H_3O^+ ions is formed; their concentration can range between 0.106 and 0.10 moles/liter, depending on the strength and amount of the acid. Therefore, acid solutions have a pH ranging from 6 (for a weak acid) to 1 (for a strong acid). Inversely, a basic solution has a low concentration of H_3O^+ ions and an excess of OH^- ions, and the pH ranges from 8 (for a weak base) to 14 (for a strong base).

HARDNESS—A property of water which causes an increase in the amount of soap that is needed to produce foam or lather and that also produces scale in hot water pipes, heaters, boilers and other units in which the temperature of water is increased materially. Hardness is produced almost completely by the presence of calcium and magnesium salts in solution. The following scale may assist in appraising water hardness, measured by weight of dissolved salts (in milligrams) per unit (in liters) of water:

[1] ***Soft***—0-60 milligrams/liter (mg/l);
[2] ***Moderately Hard***—61-120 mg/l;
[3] ***Hard***—121-180 mg/l; and
[4] ***Very Hard***—over 180 mg/l.

To convert from milligrams per liter (mg/L) to grains per gallon, use the following formula:

hardness in mg/L / 17.1 = hardness in grains per gallon

ALKALINITY
The capacity of water for neutralizing an acid solution. Alkalinity of natural waters is due primarily to the presence of hydroxides, bicarbonates, carbonates and occasionally borates, silicates and phosphates. It is expressed in units of milligrams per liter (mg/l) of $CaCO_3$ (calcium carbonate) or as microequivalents per liter (ueq/l) 20 ueq/l = 1 mg/l of $CaCO_3$. A solution having a pH below 4.5 contains no alkalinity. Low alkalinity is the main indicator of susceptibility to acid rain. Increasing alkalinity is often related to increased algal productivity. Lakes with watersheds that have sedimentary carbonate rocks are high in dissolved carbonates (hard-water lakes). Whereas lakes in granite or igneous rocks are low in dissolved carbonates (soft water lakes).

IRON
A silvery white or gray, soft, ductile, malleable, somewhat magnetic metal. Oxidizes to rust under certain conditions. Can cause discoloration of concrete or structures if water used for irrigation is high in Iron.

SALT
A chemical class of ionic compounds formed by the combination of an acid and a base. Most salts are the result of a reaction between a metal and one or more nonmetals.

BACTERIA
Microscopic unicellular organisms, typically spherical, rod-like, or spiral and threadlike in shape, often clumped into colonies. Some bacteria cause disease, while others perform an essential role in nature in the recycling of materials, for example, decomposing organic matter into a form available for reuse by plants. Some forms of bacteria are used to stabilize organic wastes in wastewater treatment plants, oil spills, or other pollutants. Disease-causing forms of bacteria are termed "pathogenic." Some forms of bacteria harmful to man include:

[1] ***Total Coliform Bacteria***—A particular group of bacteria that are used as indicators of possible sewage pollution. They are characterized as aerobic or facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 3C. In the laboratory these bacteria are defined as all the organisms that produce colonies with a golden-green metallic sheen within 24 hours when incubated at 35C plus or minus 1.0C on M-Endo medium (nutrient medium for bacterial growth). Their concentrations are expressed as numbers of colonies per 100 milliliter (ml)l of sample.

[2] ***Fecal Coliform Bacteria***—Bacteria that are present in the intestine or feces of warm-blooded animals. They are often used as indicators of the sanitary quality of the water. In the laboratory they are defined as all the organisms that produce blue colonies within 24 hours when incubated at 44.5C plus or minus 0.2C on M-FC medium (nutrient medium for bacterial growth). Their concentrations are expressed as numbers of colonies per 100 ml of sample.

[3] ***Fecal Streptococcal Bacteria***—Bacteria found also in the intestine of warm-blooded animals. Their presence in water is considered to verify fecal pollution. They are characterized as gram-positive, cocci bacteria which are capable of growth in brain-heart infusion broth. In the laboratory they are defined as all the organisms that produce colonies which produce red or pink colonies within 24 hours at 35C plus or minus 1.0C on KF-streptococcus medium (nutrient medium for bacterial growth). Their concentrations are expressed as numbers of colonies per 100 ml of sample.

TURBIDITY
The term "turbid" is applied to waters containing suspended matter that interferes with the passage of light through the water or in which visual depth is restricted. The turbidity may be caused by a wide variety of suspended materials, such as clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, plankton and other microscopic organisms and similar substances. Turbidity in water has public health implications due to the possibilities of pathogenic bacteria encased in the particles and thus escaping disinfection processes. Turbidity interferes with water treatment (filtration), and affects aquatic life. Excessive amounts of turbidity also make water aesthetically objectionable. The degree of the turbidity of water is measured by a *Turbidimeter*.

COLOR
(1) Measured in units that relate to a standard. A yellow-brown natural color is associated with lakes or rivers receiving wetland drainage. The average color value for Wisconsin lakes is 39 units, with the color of state lakes ranging from zero to 320 units. Color also affects light penetration and therefore the depth at which plants can grow. (2) One control of light transmission through water. High color values in many lakes result from the decomposition of vegetation, which gives the water a brown, tea-like color. Determined by a comparison with standardized colored-glass discs and reported in platinum-cobalt (Pt-Co) units.